CLAIMS

What is claimed is:

1. An inverter control method for a three-phase motor comprising three first switches connected between each of phase terminals of the three-phase motor and a positive terminal of a DC power of the three-phase motor, and three second switches connected between each of the phases and a negative terminal of the DC power of the three-phase motor, comprising:

disposing three maximum phase voltage vectors each having an equivalent angle interval corresponding to maximum values of each phase voltage;

setting maximum phase voltage vector regions by predetermined angles with respect to each of the maximum phase voltage vectors;

setting minimum phase voltage vectors corresponding to the maximum phase voltage vectors in between the maximum phase voltage vector regions;

obtaining a desirable voltage by turning on a first switch and turning off a second switch, both connected to the phase terminal of a corresponding maximum phase voltage in each maximum phase voltage vector region; and

changing a duty ratio of control signals with respect to the other switches corresponding to the other two phase voltages.

2. The inverter control method for a three-phase motor according to claim 1, further comprising:

turning on the first switch and turning off the second switch connected to the phase terminal having a maximum phase voltage in the maximum phase voltage vector regions, and having a phase difference in 180 degrees with each of the minimum phase voltage regions; and

obtaining the desirable voltage by changing the duty ratio of the control signals in the switches corresponding to other two phase voltages.

3. The inverter control method for a three-phase motor according to claim 1, wherein the each phase voltage region is formed by a same angle.

4. The inverter control method for a three-phase motor according to claim 2, wherein the each phase voltage vector region is formed by a same angle.

5. The inverter control method for a three-phase motor according to claim 1, wherein the duty ratio is calculated based on a ratio of the other two phase voltages and the maximum phase voltage of the maximum phase voltage vector to line voltages between the phase voltages of the phase terminals and voltages of the DC power.

6. The inverter control method for a three-phase motor according to claim 2, wherein the duty ratio is calculated based on a ratio of the other two phase voltages and the maximum phase voltage of the maximum phase voltage vector to line voltages between the phase voltages of the phase terminals and voltages of the DC power.

7. The inverter control method for a three-phase motor according to claim 1, further comprising:

connecting an output terminal of the inverter to each phase terminal of the three-phase motor in a three phase balance.

8. The inverter control method for a three-phase motor according to claim 1, wherein voltages of each phase terminal becomes a phase voltage (Vuo, Vvo, and Vwo) relative to a neutral point (0) of the three-phase motor.

9. The inverter control method for a three-phase motor according to claim 1, wherein the control signals are each input through gate terminals of the first switch and the second switch of each phase of the inverter and the control signals control a switch on and a switch off.

10. The inverter control method for a three-phase motor according to claim 1, wherein each phase voltage vector has a value of 1 by turning on the first switch and turning off the second switch, and a value of 0 by turning off the first switch and turning on the second switch, so that the inverter having six switches has eight phase voltage vectors (V0~V7).

11. The inverter control method for a three-phase motor according to claim 1, wherein a relation between continuity times of each phase (Tu, Tv, and Tw) and average output voltages (Vun, Vvn, and Vwn) on a basis of a negative terminal (n) of the DC power, is as follows:

$$Vun = Vdc\frac{Tu}{Ts} \qquad Vvn = Vdc\frac{Tv}{Ts} \qquad Vwn = Vdc\frac{Tw}{Ts}.$$

where Ts is a pulse interval in a duty cycle of the control signal applied to the first switch.

12. The inverter control method for a three-phase motor according to claim 1, further comprising:

calculating a voltage Von on a basis of the negative terminal of the DC power in the neutral point (0) of the three-phase circuits:

$$Von = \frac{1}{3}(Vun + Vvn + Vwn) = \frac{1}{3}\frac{Vdc}{Ts}(Tu + Tv + Tw).$$

13. The inverter control method for a three-phase motor according to claim 1, wherein a relationship between an output phase voltage and a continuity time of the switch is as follows:

$$\begin{bmatrix} Vuo \\ Vvo \\ Vwo \end{bmatrix} = \begin{bmatrix} Vun \\ Vvn \\ Vwn \end{bmatrix} - \begin{bmatrix} Von \\ Von \\ Von \end{bmatrix} = \frac{1}{3}\frac{Vdc}{Ts}\begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix}\begin{bmatrix} Tu \\ Tv \\ Tw \end{bmatrix}.$$

14. The inverter control method for a three-phase motor according to claim 1, wherein when phase voltage vectors are placed on the phase voltage vectors region having (1,1,1) as the origin vector, the Tu equals Ts and a calculation of continuity times of the each phase comprises:

$$\begin{bmatrix} Tu \\ Tv \\ Tw \end{bmatrix} = \begin{bmatrix} Ts \\ Ts \\ Ts \end{bmatrix} - \frac{Ts}{Vdc}\begin{bmatrix} Vuo - Vuo \\ Vvo - Vuo \\ Vwo - Vuo \end{bmatrix} = \begin{bmatrix} Ts \\ Ts \\ Ts \end{bmatrix} - \frac{Ts}{Vdc}\begin{bmatrix} 0 \\ Vvu \\ Vwu \end{bmatrix}.$$

15. The inverter control method for a three-phase motor according to claim 1, wherein when the phase voltage vectors are placed on the phase voltage vectors region having (0,0,0) as the origin vector, the Tw equals zero (0) and a calculation of continuity times of the each phase comprises:

$$\begin{bmatrix} Tu \\ Tv \\ Tw \end{bmatrix} = \frac{Ts}{Vdc}\begin{bmatrix} Vuo - Vwo \\ Vvo - Vwo \\ Vwo - Vwo \end{bmatrix} = \frac{Ts}{Vdc}\begin{bmatrix} Vuw \\ Vvw \\ 0 \end{bmatrix}.$$

where Tu, Tv, and Tw indicate pulse times of the duty cycle, which the first switch of each phase is an on-state, Vuo, Vvo, and Vwo are the phase voltage respectively corresponding to each of the phase terminals (u-phase, v-phase, and w-phase), respectively.

16. A controlling apparatus of an inverter for a three-phase motor comprising three first switches connected between each phase terminal of the three-phase motor and a positive terminal of a DC power of the three-phase motor, and three second switches connected between each of the phases and a negative terminal of the DC power, comprising:

a vector region determination part receiving a phase voltage of the each phase terminal as an input and calculating a vector region parameter using a logical calculation using a sign function returning 1 when a received phase voltage has a positive value and returning 0 when the received phase voltage has a negative value, the logical calculation comprising:

region1 = sign (Vuo) & ~sign (Vvo) & ~sign (Vwo)
region2 = sign (Vuo) & sign (Vvo) & ~sign (Vwo)
region3 = ~sign (Vuo) & sign (Vvo) & ~sign (Vwo)
region4 = ~sign (Vuo) & sign (Vvo) & sign (Vwo)
region5 = ~sign (Vuo) & ~sign (Vvo) & sign (Vwo)
region6 = sign (Vuo) & ~sign (Vvo) & sign (Vwo)

wherein, region1, region2, region3, region4, region5, and region6 are the vector region parameters indicating the phase voltage vector regions, and Vuo, Vvo, and Vwo indicate the phase voltage of a u-phase voltage, a v-phase voltage, and a w-phase voltage of the motor, respectively;

a line voltage comparative generation part receiving the phase voltage as an input and calculating a line voltage comparative signal using a duty ratio calculated based on a ratio of line voltages between each of the phase voltages to the DC power; and

an inverter control part calculating first control signals of the first switch of the inverter using a following logical calculation, and generating speed control signals of the second switch having a phase difference in 180 degrees with the first control signal

Su= region1 + Swu & (region2 + region5)
+ Suv & (region3 + region6)
Sv= region3 + Suv & (region1 + region4)
+ Suw & (region2 + region5)

$$Sw = region5 + Swu \ \& \ (region3 + region6) + Suv \ \& \ (region1 + region4)$$

wherein, Su, Sv, and Sw indicate the first control signal, and Suv, Svw, and Swu indicate the line voltage comparative signal, respectively, corresponding to each of the line voltages.